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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/929,894	08/14/2001	Henry Esmond Butterworth	GB920000053US1	9289

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EXAMINER

LE, MIRANDA

ART UNIT	PAPER NUMBER
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2167

DATE MAILED: 02/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/929,894	BUTTERWORTH, HENRY ESMOND	
	Examiner	Art Unit	
	Miranda Le	2167	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 October 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This communication is responsive to Amendment , filed 10/08/2004.
2. Claims 1-27 are pending in this application. Claims 1, 14, 27 are independent claims. In the Amendment, no claims have been added, cancelled, and amended. This action is made Final.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-2, 4-15, 17-18, 21-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burkes et al. (US Patent No. 5,604,902).

As to claims 1, 14, 27, Burkes teaches a method for performing free space collection (i.e. garbage collection) in an information storage system having storage units in which information segments are located, the method comprising the steps of: determining a fitness value (i.e. a weight value, col. 8, lines 30-35) for at least some of the segments by determining the product of the amount of free space (i.e. a number of holes, col. 8, lines 30-35) in the segment and the

expected time the free space will last (i.e. the ages of the blocks in the area, col. 8, lines 30-61, Fig. 4).

Burkes teaches the amount of free space as number of holes (col. 8, line 42); the expected time as the ages (i.e. time) of the blocks (i.e. segments) in the area (col. 8, line 31); and the conjunction of the free space and the expected time (col. 8, lines 27-29).

It would have been obvious to modify the Burkes method to implement the fitness value computation by multiplying the amount of free space in the segment and the expected time the free space will last to select one segment for free space collection over another (i.e. moving data to unused storage space and freeing (defragmenting) an area with fewer I/O moves), because it would help to optimize data storage management system, and provide better overall garbage collection efficiency and performance.

Burkes teaches choosing segments for free space collection with the maximum fitness values (col. 8, lines 38-59).

As to claims 2, 15, Burkes teaches the expected time the free space in a given segment will last is estimated by the rate of use of still-in-use data in the segment (i.e. a percentage (rate) derived from the holes (free space) or use count (in-use data)), (col. 8, lines 43-44).

As to claims 4, 17, Burkes teaches the segment age is measured in one of real time, number of write transactions, number of segments written or destage sequence number (col. 8, lines 16-61).

As per claim 5, Burkes teaches the segment age is one of an average, maximum or minimum of the ages of the data in the segment (col. 8, lines 16-36).

As per claim 6, Burkes teaches the segment age also includes a write interval for the segment (col. 9, lines 9-52).

As per claim 7, Burkes teaches a fitness value is determined for one of each of a group of sorted segments (col. 9, lines 9-52).

As per claim 8, Burkes teaches the segments are sorted by the amount of used data in each segment, each group of segments having a given range of amount of used data (col. 8, lines 16-61, col. 10, lines 1-46).

As per claim 9, Burkes teaches all full segments are sorted into one group and the remaining groups have equal ranges of amounts of used data (col. 10, lines 1-46).

As to claims 10, 21, Burkes teaches the segments are listed within each group in a first-in first-out list and the fitness value is determined for the segment at the head of the list (col. 8, lines 16-61, col. 10, lines 1-46).

As to claims 11, 22, Burkes teaches the segments are sorted within each group by the time at which the data in the segment was last written or by a destage sequence number and the fitness value is determined for the segment with the greatest age in each group (col. 9, lines 9-52).

As to claims 12, 23, Burkes teaches the segments are sorted by a tree data structure (col. 10, lines 46-59).

As to claims 13, 24, Burkes teaches the method is used in a log structured information storage system (col. 8, lines 46-59, col. 3, lines 51-67, col. 10, lines 46-59).

As per claim 18, Burkes teaches the segments are sorted into groups and the means for determining a fitness value is applied to one segment from each group (col. 10, lines 1-46, col. 8, lines 16-59).

As per claim 25, Burkes teaches the storage system is a log structured file system (col. 8, lines 46-59, col. 3, lines 51-67, col. 10, lines 46-59).

As per claim 26, Burkes teaches the information storage system is an external storage system and is a log structured array (col. 8, lines 46-59, col. 3, lines 51-67, col. 10, lines 46-59).

5. Claims 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burkes et al. (US Patent No. 5,604,902), in view of Moore et al. (US Patent No. 6,282,605 B1).

As per claim 19, Burkes does not explicitly teach “the segments are sorted by the amount of used data in each segment, each group of segments having a given range of amount of used data”. However, Moore teaches this limitation at col. 2, line 37 to col. 3, line 45.

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the cited references because Moore’s teaching of “the segments are sorted by the amount of used data in each segment, each group of segments having a given range of amount of used data” would have allowed Burkes’s to efficiently and consistently organize and maintain a data storage system at the highest performance and reliability.

As per claim 20, Moore teaches all full segments are sorted into one group and the remaining groups have equal ranges of amounts of used data (col. 2, line 37 to col. 3, line 45).

Allowable Subject Matter

6. Claims 3, 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

7. Applicant's arguments filed 10/08/2004 have been fully considered but they are not persuasive. The Examiner has thoroughly reviewed Applicants' arguments but firmly believes that the cited reference reasonably and properly meet the claimed limitation. Applicants are reminded that the Examiner is entitled to give the broadest reasonable interpretation to the language of the claimed as explained below. The Examiner is not limited to Applicants' definition which is not specifically set forth in the claims. In re Tanaka et al., 193 USPQ 139, (CCPA) 1977.

The following arguments made by Applicants are considered relevant:

(a) Burkes does not teach/suggest any concepts which correspond to a fitness value in view of the claim language or the specification.

(b) Burkes does not teach/suggest "product of the amount of free space in the segment and the expected time the free space will last".

(c) There is no teaching or motivation in Moore to combine it with Burkes.

The Examiner respectfully disagrees for the following reasons:

Per (a), it is brought to the Applicant's intention that in accordance with the present invention which defines a fitness value as "a function used to determine the segment fitness for selection for free space collection (Specification, page 29, lines 1-2); and, "determining a fitness value by determining the product of the amount of free space in the segment and the expected time the free space will last" (Specification, page 14, lines 1-4); Burkes, similarly, teaches the fitness value as "to characterize areas according to their fragmentation percentage, hole count (i.e. free space amount), use count, or other **figure of merit** (i.e. fitness value) that is a **function** of fragmentation (i.e. free space), perhaps **in conjunction** (a relationship) with **some other value** (i.e. time). An example of a **figure of merit is a value** (fitness value) that weights fragmentation with the **ages** (i.e. time) of the blocks in the area (i.e. expected time), (col. 8, lines 25-32).

Therefore, it is evident that Burkes does teach concept of a fitness value in view of the claim language. The knowledge that is within the level of one of ordinary skill is highlighted hereinabove for the Applicant's convenience. The Examiner believes that the Applicant has failed to determine the level of ordinary skill as taught by Burkes.

Further, Applicant's arguments seem to be suggesting "the specification takes great lengths to define the term and its associated fitness function". In response to the preceding argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., fitness value is a characteristic of a segment, identifies a degree of suitability of one segment for selection for free space collection...) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification,

limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Per (b), under similar rational as provided in (a), the same reasoning would be applicable to (b). Burkes does not particularly teach “product of the amount of free space in the segment and the expected time the free space will last”, but Burkes teaches the amount of free space as number of holes (col. 8, line 42); the expected time as the ages (i.e. time) of the blocks (i.e. segments) in the area (col. 8, line 31); and the **conjunction** of the **free space** and the **expected time** (col. 8, lines 27-29).

Thus, it would have been obvious to modify the Burkes method to implement the fitness value computation by multiplying the amount of free space in the segment and the expected time the free space will last to select one segment for free space collection over another (moving data to unused storage space and freeing (defragmenting) an area with fewer I/O moves), because it would help to optimize data storage management system, and provide better overall garbage collection efficiency and performance.

Per (c), Applicant’s arguments seem to be suggesting that there is no suggestion to combine the references. In response to the preceding argument, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of

ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

In this case, Burkes is directed to computer data storage management, and in particular, to reducing fragmentation in data storage so that contiguous free storage space provides optimum performance in memory devices (col. 1, lines 6-8).

Moore is directed to a system for ascertaining the physical location of files in random access memories, in which data is written in blocks of various sizes and in which erasure of data to recover memory space for rewriting of data is constrained to relatively large zones of contiguous locations (col.1, lines 6-7, 15-19).

Burkes teaches the step of computing the fitness value as mentioned in (a) and (b), Bukes, however, does not specifically teach the step of sorting and grouping the segments. Moore teaches data storage management system, which sorts and groups the segments into buckets (or the group of entries at each node by the amount of used data, e.g. the length of the block).

It would have been obvious to one ordinarily skilled in the art at the time of the invention to combine the cited references because they both teach data storage management systems, and the incorporation of Moore's in the combined system would have enhanced the performance of the Burkes system by efficiently and consistently organizing and maintaining data stored in the data storage system at the highest performance and reliability.

Accordingly, the claimed invention as represented in the claims does not represent a patentable over the art of record.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Miranda Le whose telephone number is (571) 272-4112. The examiner can normally be reached on Monday through Friday from 8:30 AM to 5:00 PM.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John E. Breene, can be reached on (571) 272-4107. The fax number to this Art Unit is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 305-3900.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Miranda Le
February 04, 2005


JOHN E. BREENE
SUPERVISOR